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Cross-culture adaptation and validation of the Arabic version of duruöz's hand index for people with carpal tunnel syndrome

Wael Alghamdi

ABSTRACT

Background and Aims: Carpal tunnel syndrome is a clinical syndrome resulting from the wrist's median nerve being compressed, which resulting in function impairment and pain at the wrist. This study aims to translate and validate the Arabic version of the Duruöz's Hand Index in patients with carpal tunnel syndrome. **Methods:** Cross cultural adaptation was performed according to guidelines. Seventy-one Arabic participants with carpal tunnel syndrome were recruited. Test retest reliability was assessed after average of two weeks by measuring the interclass correlation coefficient. Cronbach's Alpha was performed to analyse the internal consistency. To assess construct validity; Person correlation coefficient with Boston Carpal Tunnel Questionnaire was calculated. **Results:** Arabic version of the Duruöz's Hand Index had excellent internal consistency; Cronbach's Alpha was 0.95 for the overall of the Duruöz's Hand Index. Test-retest reliability was excellent. Correlation with the Boston Carpal Tunnel Questionnaire reflects an excellent validity. **Conclusions:** The Arabic translation of the Duruöz's Hand Index is reliable, valid, and reproducible. The Arabic version is now suitable for use in Arabic-speaking participants with carpal tunnel syndrome.

Keywords: Carpal tunnel syndrome, Duruöz's Hand Index, Boston Carpal Tunnel Questionnaire, validity, and reliability.

1. INTRODUCTION

Carpal tunnel syndrome (CTS) is a clinical syndrome resulting from the wrist's median nerve being compressed, which resulting in function impairment and pain at the wrist (Katz and Simmons, 2002). The carpal tunnel is located at the anterior of the wrist and is surrounded by ligaments and bones. Patients with the CTS may feel tingling, numbness and pain in the three initial digits and in the median half of the 4th finger (median nerve suppler); these symptoms commonly appear at night, and they usually lead to

sleep disturbance. Activities of daily living will be negatively affected in individuals with CTS (Dabbagh et al., 2020; Genova et al., 2020; Maher, 2007).

CTS is a disease that commonly seen entrapment mononeuropathy of the upper limb (Alfonso et al., 2010). Data show that the prevalence of CTS is 9.2%-15.6% in females and 6% -11.3% in males (Mondelli et al., 2002; Papanicolaou et al., 2001). Usually, CTS occurs in all ages groups, but bilateral CTS is seen mostly in people aged over 40 years old (Phalen, 1966). In the USA and the UK, the prevalence of CTS is around 5% and 10%, respectively (De Krom et al., 2008; Somaiah and Roy, 2008). The diagnosis of CTS can be done clinically and through physical examination, employing tests such as: the hand elevation test, the Phalen test and the Tinel sign. Electrodiagnostic studies could be used for CTS. It can be treated both surgically and conservatively (Dabbagh et al., 2020; De Krom et al., 2008).

The Duruöz's Hand index (DHI) is a self-reported questionnaire developed by Duruöz et al., (1996) and it is also known as Hand Functional Disability Scale and the Cochin Scale. The DHI is based on 18 questions concerning activities of daily living. The questions are grouped into five domains related to hands in the kitchen, whilst dressing, whilst proceeding personal hygiene, whilst preceding office tasks, and other general items. People rate their ability from zero (no difficult) to five (impossible to do). The range of possible score on the questionnaire is 0 to 90, with a higher score indicating poor hand function. It takes about 3 minutes to complete (Duruöz et al., 1996). Studies show that the DHI is reliable and valid in people with arthritis (Baillet et al., 2009; Erçalik et al., 2011), stroke (Sezer et al., 2007), spinal injuries (Brower and Poole, 2004) and diabetes (Turan et al., 2009).

Although the Boston Carpal Tunnel Questionnaire (BCTQ) is a widely used specific test for CTS, the DHI has recently been used to diagnose the CTS. Gökşenoglu et al., (2018) and Küçük and Taşkiran, (2020) found that the DHI is valid and reliable tools in patients with CTS. The DHI has been interpreted into a number of languages (Baillet et al., 2009; Duarte et al., 2014; Ingegnoli et al., 2008) and to enable it to be used internationally, it should be translated into local languages and culturally adapted. Therefore, the purpose of this research is to analyze and validate the translated Arabic version of the DHI.

2. MATERIALS AND METHODS

Participants and setting

The participants were seventy-one male and female (Table 1) Arabic-speaking patients with CTS who were referred to the Department of Rehabilitation at King Fahad Hospital in Al Baha and the Al-Mandag Hospital between June and November 2021. The inclusion criteria for these patients were: native Arabic speaking, clinically assessed for CTS and ability to read, understand, and answer the questionnaire. Exclusion criteria in this study were participants who had surgery on their hand, hand deformities, arthritis, or communication problems.

Table 1 Characteristics of participants

| Variable | Mean (SD) or N (%) |
|---|--------------------|
| Number of participants (N) | 71 |
| Number of participants completed the outcome measures (N) | 58 |
| Sex (M/F, %) | 53.5/46.4 |
| Age (Mean / SD, Years) | 42 ±14.7 |
| Right-handed, (%) | 98 |

Procedure

The demographic of the patients was recorded during the patients' first visit. Tinel's and Phalen's clinical tests were administrated. The patients were then asked to complete the Arabic translation of the DHI (DHI-AR) and the BCTQ. Two weeks later, all the patients were asked to complete the DHI- AR again. They all signed the informed written consent form, and this research procedure was approved by the Scientific and Research Committee of the King Fahad Hospital, Al Baha with Reference number: KFH, IRB/O3112021/4.

Outcome measures

DHI

The DHI is a self-reported questionnaire designed by the patient's doctor to evaluate the activity of the hand (Duruöz et al., 1996). The questionnaire is divided into five domains, and it contains 18 items regarding hand ability in the kitchen, whilst dressing,

whilst proceeding personal hygiene, whilst proceeding office tasks, and other general items. The patients are instructed to rate their level of difficulty with completing certain tasks without help from others. The questionnaire is graded on the six-point Likert scale where 0 = done without difficulty and 5 = impossible to do. Summing the scores for the 18 items gives a score from 0 to 90, with a higher score indicating poor hand functioning.

Boston Carpal Tunnel Questionnaire

The BCTS is a diagnostic tool that contains two scales: the symptoms severity scale (SSS) and the function status scale (FSS). The SSS consists of 11 items with six domains (pain, numbness, paresthesia, nocturnal symptoms, weakness, and overall function) and each is scored on a scale of five where 1 = never/none and 5 = most severe. The FSS contains eight functions and activities, and it is also scored on a scale of five: 1 = no difficulty and 5 = cannot perform the activity at all. This questionnaire has been translated and validated in an Arabic language (Alanazy et al., 2019; Hamzeh and Alworikat, 2021).



Figure 1 Cross culture adaptation process of the Arabic translation of the DHI.

Translation process

The guidelines for cross-cultural adaptations of assessment tools were used for translating the English version of the DHI into Arabic (Beaton et al., 2000) (Figure 1). This included forward translation, back translation, and patient testing. Two translators

whose mother tongue was Arabic prepared the Arabic translation of the DHI from English to Arabic. One translator was a physiotherapist and the second was a native Arabic speaker fluent in English. Both versions of the translations were assessed by a professional translator (Arabic-English), and then back translation was performed by two other (Arabic-English) translators who did not have access to the original version of the DHI. A comparison of the backward version with the original source version was carried out by a review committee. This committee made changes to the first version, giving rise to the second version. The last step in the linguistic validation was to test the questionnaire with patients with CTS in order to ascertain whether the language was acceptable and understood and whether it was simple and appropriate.

Statistical analysis

This section describes the statistical tests employed in this study and the results are presented in the following section. Data analysis was performed using IBM SPSS 22 for Windows. The inter-class correlation coefficient (ICC) was run to determine the test-retest reliability of the DHI-AR between days. An ICC more than 0.7 was considered excellent reliability (Cicchetti, 1994). Standard error of measurement (SEM) was calculated by the following equation: $SEM = \text{pooled SD} * \sqrt{(1 - ICC)}$. As the pooled SD = $\sqrt{(\text{SD1})^2 + (\text{SD2})^2}/2$ (Cohen, 1988; Denegar and Ball, 1993), the SEM of the DHI-AR was 3.5.

Cronbach's Alpha was performed to examine the internal consistency of the DHI-AR and it was 0.7, which is considered as good internal consistency (Prinsen et al., 2018; Terwee et al., 2012). In addition, the correlation between the DHI-AR and the BCTQ was tested by the Pearson coefficient, where a value of more than 0.7 is considered as a strong correlation.

3. RESULTS

Seventy-one subjects with CTS patients in the research and completed the outcomes measures on their first appointment. Fifty-eight subjects out of 71 completed the outcome measures on their second appointment. No missing items were noted in the DHI-AR. Out of all the participants in the study, 46.4% were female and 53.5% were male, aged from 18 to 65 (42 ± 14.7).

Test-retest reliability

Test-retest reliability was determined in our study by the participants completing the questionnaire twice on two visits separated by an average of five days. The mean total score for the first assessment was 46.8 ± 14.2 and for the second assessment it was 46.2 ± 14.9 , meaning that there was no significant differences among the two assessments ($p = .5$). The inter-class correlation coefficient between the total test and retest results was high (0.90) and statistically significant ($p < .01$). In addition, a strong correlation was noted between the single items, as can be seen in Table 2.

Table 2 Test re-test reliability results

| Variable | Test mean (SD) | Re-test mean (SD) | ICC (95% CI) | P value |
|----------|----------------|-------------------|---------------|---------|
| Total | 46.8 (14.2) | 46.2 (14.9) | .90 (.84-.91) | < .01 |
| Kitchen | 20.7 (6.89) | 20.08 (7.15) | .81 (.70-.88) | < .01 |
| Dressing | 5.25 (1.89) | 5.46 (1.92) | .72 (.57-.82) | < .01 |
| Personal | 4.86 (1.40) | 4.84 (1.65) | .68 (.30-.68) | < .01 |
| office | 5.01 (1.84) | 5.15 (2.13) | .79 (.49-.78) | < .01 |
| other | 10.96 (3.97) | 10.65 (3.65) | .90 (.72-.89) | < .01 |

ICC: inter-class correlation, CI: confidence interval, SD: standard deviation.

Internal consistency

Results show that the internal consistency was excellent. Particularly, cronbach's Alpha was 0.95 for the overall DHI-AR. Furthermore, as shown in Table 3, after deleting one item, Cronbach's Alpha ranged from .88 to .83, indicating strong internal consistency.

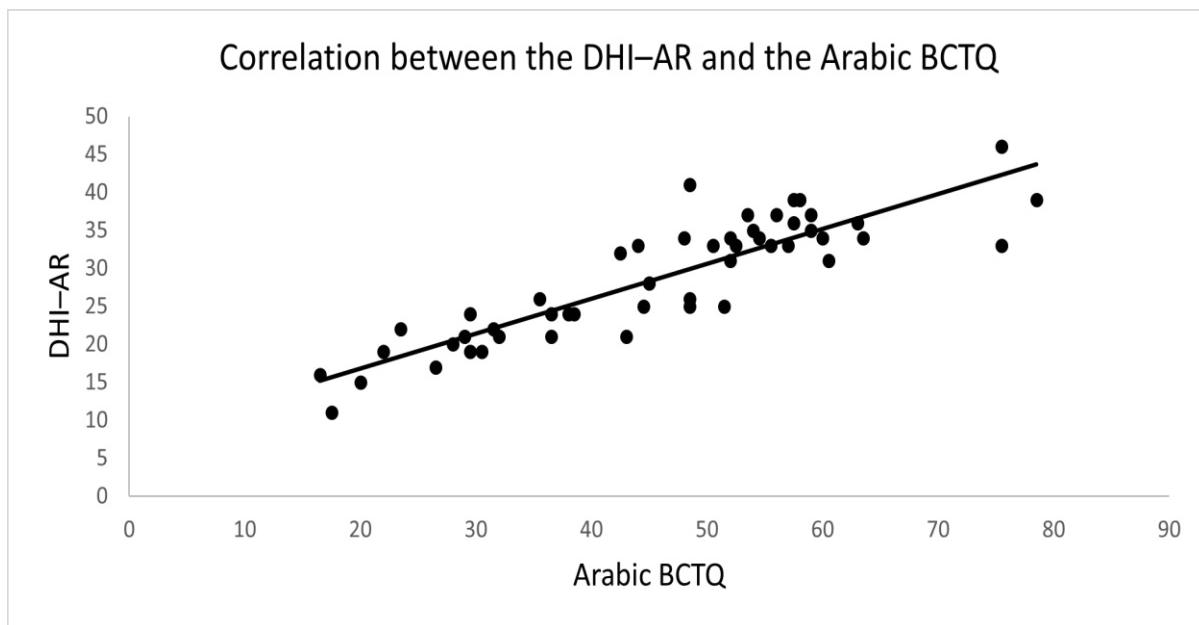
Construct validity

Figure 2 showed that a strong correlation between the DHI-AR and the Arabic BCTQ ($Rs = 0.82$, $p < .01$). In addition, the correlation between the DHI-AR and the SSS ($Rs = 0.84$, $p < .01$) was higher than that between the DHI-AR and the FSS ($Rs = 0.72$, $p < .01$).

Table 3 Internal consistency of the DHI-AR

| Variable | Mean (SD) | Scale means if item is deleted | Scale variance if item is deleted | Adjusted item-total correlation | Item-item correlation | Cronbach's alpha if item is deleted. |
|----------|--------------|--------------------------------|-----------------------------------|---------------------------------|-----------------------|--------------------------------------|
| Total | 46.8 (14.2) | 128.65 | 1600.82 | .96 | 1 | .83 |
| Kitchen | 20.7 (6.89) | 154.72 | 2280.2 | .86 | .99 | .86 |
| Dressing | 5.25 (1.89) | 170.22 | 2731.01 | .81 | .99 | .88 |
| Personal | 4.86 (1.40) | 170.62 | 2796.24 | .65 | .98 | .88 |
| office | 5.01 (1.84) | 170.46 | 2735.65 | .80 | .99 | .88 |
| other | 10.96 (3.97) | 164.51 | 2508.81 | .93 | .99 | .87 |

SD: standard deviation.

**Figure 2** Scatter diagram showing the correlation between the DHI-AR and the BCTQ ($R_s = 0.82$, $p > .01$).

4. DISCUSSION

CTS are a very common condition that impacts many people around the world. The present study was designed to translate the DHI into Arabic and to test its construct validity, internal consistency, and test-retest reliability. The study's results are consistent with our hypothesis, which suggested that an Arabic version of the DHI would be a reliable and valid method with which to evaluate patients with CTS. This Arabic version is in line with earlier literature on the original English version (Duruöz et al., 1996), the Italian version (Ingegnoli et al., 2008), and the Argentinian population (Duarte et al., 2014) concerning its test-retest reliability and internal and external consistency.

In terms of relative reliability, the results of this study demonstrate that the DHI-AR has excellent reliability, as shown by the ICC value of 0.90. This shows that the DHI-AR has relatively low systematic and random error linked with repeated administrations over time. This value is improved by observing the ICC 95% confidence interval that has a lower limit of 0.68 beyond the minimum recommended reliability level (Terwee et al., 2012; Prinsen et al., 2018). This study found that all of the ICC values reflected the excellent test-retest reliability of the DHI-AR, in good agreement with the results of previous studies (Duruöz et al., 1996; Erçalik et al., 2011; Ingegnoli et al., 2008; Sezer et al., 2007; Turan et al., 2009).

The psychometric characteristics of the DHI-AR showed an excellent level of correlation and were highly acceptable, as indicated by the Cronbach's Alpha value of 0.82. This Cronbach's Alpha value demonstrates that the index does not suffer from redundancy among the elements. The present Alpha values seem to be consistent with other research in the original study (Duruöz et al., 1996) and other validation studies (Erçalik et al., 2011; Ingegnoli et al., 2008; Turan et al., 2009), which also reported an

excellent internal consistency. In addition, the deletion of individual elements did not have a large effect on the Alpha value (Table 3), which indicates that all the items are highly correlated.

The results of the current study showed that a strong significant correlation between the DHI-AR and the SSS and FSS, having a $R_s = 0.84$, $p > .001$ and $R_s = 0.72$, $p > .001$, respectively. The correlation between the DHI-AR and the SSS was higher than the correlation between DHI-AR and the FSS. It has been suggested that a coefficient of 0.4 or greater shows that the scale has good construct validity (Cohen, 1988). This study is not without limitations. It only involved the aspects of validity and reliability, but the responsiveness of the DHI-AR is an essential outcome to measure the ability of the tool to detect change with treatment and time. Future research should therefore concentrate on the responsiveness of the DHI-AR. In addition, factor analysis was not employed as the sample size was relatively small. Nevertheless, the minimum requirement for sample size was met in this study.

5. CONCLUSION

In conclusion, the DHI-AR is a valid and reliable tool for an Arabic population with CTS. The questionnaire also demonstrated excellent internal consistency and test-retest reliability with an appropriate measurement error. The psychometric characteristics of the DHI-AR were a valid measure of CTS, which suggests the usefulness of this tool in clinical settings and for research purposes.

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Author Contribution

Research proposal preparation, Data collection, Tool preparation, Data Analysis, Preparation of final research, content writing, overview office work, and final review were done by Wael Alghamdi.

Ethical approval

The study was approved by the Scientific and Research Committee of the King Fahad Hospital, Al Baha (Ethical approval code: KFH, IRB/O3112021/4).

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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